

## **Risk and Protective Factor Survey of Lyme Disease Cases in Loudoun County, Virginia - 2009-2011**

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### **Background:**

Lyme disease is the most common vector-borne disease in Virginia. The incidence of Lyme disease in Virginia has increased over the past ten years and Loudoun County has reported one of the highest incidence rates for Lyme disease within Virginia, accounting for 25% of cases in 2011.<sup>1</sup>

Lyme disease is caused by the bacterium *Borrelia burgdorferi* and is transmitted to humans by the bite of infected blacklegged ticks (*Ixodes scapularis*). Blacklegged ticks, formerly referred to as deer ticks, are most frequently supported in moist, wooded areas where they can come in contact with suitable hosts, such as mice, deer and dogs. Blacklegged ticks typically become infected with *B. burgdorferi* as nymphs, while attached to the white-footed mouse; these ticks can transmit other tick-borne diseases as well.<sup>2</sup>

Early symptoms of Lyme disease in people include fever, headache, fatigue, and a characteristic bull's eye skin rash called erythema migrans. If left untreated, infection can spread to joints, the heart and the nervous system, leading to such conditions as arthritis, heart block and Bell's palsy. Lyme disease is primarily diagnosed based on symptoms, physical findings, and the possibility of exposure to infected ticks; laboratory testing is helpful if used correctly and performed with validated methods.

Steps to prevent Lyme disease and reduce its complications include dressing appropriately, using insect repellent, conducting daily tick checks and removing ticks promptly, keeping ticks off one's property through targeted pesticide application and by reducing tick and mouse habitats, and receiving prompt evaluation and treatment when early symptoms occur.

Lyme disease became officially reportable in Virginia in 1989 and was designated as a nationally notifiable disease in 1991.<sup>3</sup> The purpose of Lyme disease surveillance in Virginia is to identify and characterize incident cases, outbreaks, and target populations for prevention efforts, to monitor trends in disease incidence, and to maintain awareness of the disease. Surveillance case definitions do not necessarily match clinical case definitions, so the surveillance system does not necessarily capture every case that is diagnosed by a physician.

Lyme disease surveillance in Virginia falls under the state's reportable disease surveillance system, which relies on passive reporting from several sources including physicians, hospital directors, and laboratories. The 2011 case definition<sup>4</sup>, which is currently in use, classifies cases as suspected, probable, or confirmed, with only probable and confirmed cases included in the official case count.

Lyme disease has been viewed as a significant public health concern in Loudoun County since 2003. The Loudoun County Health Department and its private and public sector partners have been working to combat and track this infection through better community education, improved healthcare provider reporting, and enhancing our understanding of specific risk factors for contracting Lyme disease in Loudoun County.

In 2006, the Loudoun County Health Department (also known as Loudoun Health District) conducted two surveys to collect additional information on persons with Lyme disease in Loudoun County. A brief survey of the 371 Loudoun residents reported to have a case of confirmed Lyme disease from 2003 to 2006 ("2006 Survey1") was completed first (Appendix 2); this one page survey focused on key Lyme disease risk factors in Loudoun County using the 1996 case definition in use at that time<sup>5</sup>, with the results from the survey posted and available online at [www.loudoun.gov/lyme](http://www.loudoun.gov/lyme). A more extensive Loudoun County survey followed ("2006 Survey2"); the 95 responses to this second survey included some residents with self-reported infections in addition to the confirmed cases, and looked at risk factors for being diagnosed with Lyme disease, changes in behaviors after diagnosis, and the public health burden of this infection (Appendix 3).

The 2006 surveys found that Lyme disease cases occurred among residents of all ages and geographic locations in Loudoun County, with those over 50 years of age and in the western portion of the county disproportionately represented. Of the respondents to these surveys, only a minority had a known tick bite or a known rash, most believed they were infected on their own property, over half were diagnosed more than a month after infection, and few took protective measures on their properties. As a result of these findings, Loudoun County targeted community awareness and education efforts that included steps that residents could take to keep ticks off themselves and their property, to better recognize the signs and symptoms of Lyme disease, and to seek care promptly.

Between January 1, 2009 and December 31, 2011, there were 673 cases of Lyme disease in Loudoun County. Compared to current Census data (Tables 1-4), Lyme disease cases during this period were more likely to be from among the following population sectors: male (54% versus 50%), white (95% versus 68%) and over 50 years of age (38% versus 22%). Cases were less likely to be from east of Leesburg (26% versus 60%) or between 18-50 years of age (35% versus 48%).

#### **Purpose:**

In March 2012, the Loudoun County Board of Supervisors passed a ten point initiative to mitigate Lyme disease. As part of this initiative, the Loudoun County Health Department developed a Lyme Disease Survey to assess some factors related to Lyme disease in Loudoun County.

The objectives of this survey are to:

1. Describe characteristics, including the presence of risk or protective behaviors, of people living in Loudoun County who met the CDC case definition of Lyme disease;
2. Determine which symptoms prompted case-patients to seek medical attention.;
3. Characterize potential risk factors and preventive behaviors among persons with Lyme disease in Loudoun county; and,
4. Compare findings with 2006 surveys, when appropriate.

#### **Methodology:**

##### *Sampling*

The survey sample consisted of all persons with a case of Lyme disease reported to the Loudoun County Health Department for a three year period from January 1, 2009 through December 31, 2011 and classified as confirmed or probable, according to the 2008 CDC Notifiable Diseases Case Definition for Lyme disease.<sup>6</sup> Of the 673 cases, five did not have a complete mailing address, for a sample of 668 cases.

### *Survey Data Collection and Analysis*

A questionnaire was designed using SurveyMonkey™, a web-based survey tool (Appendix 4). Each of the 668 cases was sent an introductory letter by mail from the Loudoun County Health Department on September 1, 2012 that included instructions on how to access the survey online, a paper copy of the survey and a stamped return address envelope. A return date of September 30, 2012 was included in the instructions and no responses were included that were postmarked after October 1, 2012, the first postal collection date after the survey deadline.

Each letter was assigned a unique identifying (UID) number to maintain confidentiality and to prevent survey responses from individuals other than the 668 designated case-patients. One member of the survey team sent the letters and transcribed data from the returned paper surveys into SurveyMonkey™; this was the only member of the team with access to identifying information. Two other members of the survey team, who only had access to the UIDs, were involved in data analysis. The completed surveys were reviewed to verify that only valid UIDs were received and that there were no duplicate UIDs.

Responses were reviewed using descriptive statistical measures and denominators were adjusted to exclude respondents who skipped those questions. Some questions allowed for multiple responses; in those situations, the percentages do not equal 100% since the respondent had the option to choose more than one answer. Tests for statistical significance between two samples used 2-sample t-tests at the 95% significance level.

### **Results:**

#### *Survey Responses*

A total of 314 completed surveys were received by the response deadline, of which 277 (88%) were received via mail, with the remaining submitted electronically; the 314 responses represented an overall response rate of 47%. An additional 23 surveys (3%) were received after the deadline and were not included in the survey results, and 40 (6%) were returned due to addresses that were no longer valid. The survey results are included as tables in Appendix 1.

#### *Demographic Characteristics of Cases and Survey Respondents*

Of 310 survey respondents (Tables 1-4), 295 (95%) were white, 141 (46%) were over 50 years of age, and 77% were from eastern Loudoun County. Compared to all cases reported to LCHD, respondents were less likely to be between 18 and 35 years of age and more likely to be 65 years or older, but were otherwise demographically similar.

#### *Signs and Symptoms*

Sixty percent of 2012 survey respondents were diagnosed within a month of and 11% more than a year after symptom onset (Table 5). Twenty-nine percent recalled being bitten by a tick (Table 6). Of those with a known tick bite, 40% of respondents self-reported noting a bull's eye rash (Table 7), 59% muscle aches, 46% flu-like symptoms and 47% fatigue. Additionally, 34% self-reported noting pain and swelling in large joints, 21% arthritis, 18% chronic neurological symptoms, 16% shooting pains that interfere with sleep, 16% severe headache and neck stiffness, 8% bull's eye rash on other parts of the body and 6% facial palsy (Table 8). Those who sought care within a month of first symptoms were more likely to report a known rash (55%) and more likely to report any early symptom of Lyme disease, including known rash, muscle aches and joint pain, flu-like illness or fatigue (94%) (Table 9).

### *Risk Factors*

Of those who recalled being bitten by a tick, 63% believed they picked up the tick on their own or someone else's private property, 19% in a park or wooded area within Loudoun County and 5% outside Loudoun (Table 10). Consistent with this, their most common activities cited when bitten included gardening (40%), hiking (19%), and recreational sports (11%) (Table 11).

Sixty-three percent of respondents primarily worked indoors, with 23% reporting significant exposure to nature (Table 12). Sixty-one percent averaged one to three hours outdoors each day during peak Lyme disease infection months, with 25% spending four or more hours outdoors per day during this period (Table 13). Of the respondents, 54% described their residence as being rural (Table 14), 64% lived on a house on over a half acre and 55% lived less than 99 feet from a wooded area (Table 15), with only 8% living in a townhouse or apartment.

Most respondents observed deer or mice around their home (90%) or a tick on a pet (66%) (Table 16). Those in western Loudoun County were more likely than those in the east to have a known tick on their pets (75%), to believe they were infected on their own property (70%) and to have observed deer and mice around their home (94%) (Table 17).

### *Personal and Environmental Protection Before and After Lyme Disease Diagnosis*

Compared to before being diagnosed with Lyme disease, after receiving a diagnosis of Lyme disease respondents were more likely to check for ticks (92% versus 85%), wear long sleeves and pants (38% versus 24%), use insect repellent (55% versus 34%) and tuck their pants into socks (14% versus 6%) (Table 18). Additionally, residents were more likely to use pesticides around their home (40% versus 19%) and to remove brush or leaf litter (43% versus 33%) after a diagnosis.

Before their diagnosis, respondents from western Loudoun County (88%) and those under 18 years of age (91%) were more likely to check for ticks as compared to other geographic and age groupings, respectively. Compared to other age groupings, those under 18 years of age were less likely to wear long sleeved shirts, pants and long socks (8%), less likely to tuck pants into socks (2%), and less likely to wear light-colored clothing (8%) before diagnosis. Female respondents were more likely than males to tuck their pants into socks (13%) and wear light-colored clothing (19%). Before a Lyme disease diagnosis, western Loudoun County residents were more likely than those in the eastern part of the county to remove brush or leaf litter (42%) and less likely to have no known ticks on their property (14%).

### *Comparison with 2006 Surveys*

2012 respondents were more likely than 2006 respondents to be diagnosed within a month of symptom onset (60% versus 46%), to check for ticks (85% versus 66%), to use pesticide on their property (19% versus 4%) and to remove brush or leaf litter (33% versus 9%). 2012 respondents were less likely than 2006 respondents to wear long sleeved shirts, pants and long socks (24% versus 48%), less likely to tuck their pants into their socks (6% versus 17%), and less likely to wear light-colored clothing (13% versus 58%). There was no statistically significant difference between the two survey populations in the proportion from western Loudoun County (74% versus 72%), those who recalled being bitten by a tick (29% versus 34%) or using insect repellent (34% versus 41%), those with deer or mice around their home (90% versus 86%), and in those who used wood chips or gravel barriers between woods and their yard (7% versus 10%).

## **Discussion:**

### *Findings*

This 2012 follow-up survey showed areas of success with the county's education efforts since 2006, as well as areas where continued improvement is needed. Compared to 2006, respondents in 2012 were more likely to receive care within the first month of symptom onset, to regularly check for ticks, and to control ticks on their property both through the use of pesticides and by removing brush and leaf litter. Other preventive measures, such as use of insect repellent, dressing appropriately, and using gravel or fence barriers did not change significantly from 2006. Additionally, this survey similarly found that the erythema migrans rash and tick bite were only remembered by a minority of respondents, and that, of those who had a known tick bite, performing yard work on their own property constituted the most common risk factor for contracting Lyme disease. This survey also showed a significantly higher representation amongst residents who are white and non-Hispanic.

### *Data Strengths and Limitations*

Key strengths of this study were that surveys were only distributed to those who met a standard case definition for Lyme disease and that the demographics of those who completed the surveys could be compared both to the cases and to the county's population overall. Additionally, there was a high response rate with respondents, other than age, demographically similar to the cases overall. Lastly, there was a mechanism to verify that responses only came from known cases and that no more than one response was received from each individual.

The findings in this report were subject to at least four limitations. First, the inclusion criteria of meeting the CDC case definition of a probable or confirmed case restricted those surveyed to patients infected with Lyme disease who met this epidemiologic case definition and who had access to the healthcare system. Second, reports may be skewed towards those patients for whom laboratory testing was conducted, as laboratories are excellent reporters of positive results, thereby reducing the percentage of those with known rashes. Third, recall bias may have occurred due to the length of time since the diagnosis. Fourth, compared to the 2012 survey, the 2006 surveys used a different CDC case definition and one of the 2006 survey tools (2006 Survey2) was not limited only to those who met the CDC case definition at that time.

### *Recommendations*

The survey findings should be disseminated to Loudoun County health care providers, key stakeholders and the general community, to reinforce the community's successes, to highlight areas for improvement, and to revise the focus of educational efforts on making private properties tick safe, using insect repellent, dressing appropriately, and seeking medical attention promptly should signs or symptoms of Lyme disease occur. It is also important for Loudoun County Health Department and other key stakeholders to work with the health care provider community to improve access to care for those suspected of having Lyme disease and to improve overall reporting of suspected Lyme disease cases to better reflect the true magnitude of the infection in our community. Lastly, it is recommended that Loudoun County conduct a broader community Lyme disease awareness and prevention survey to include not only persons with known cases of Lyme disease, but also include both those not infected with Lyme disease and those who were diagnosed with Lyme disease but did not meet criteria to count as a case.

## **References:**

<sup>1</sup> Data available from the Virginia Department of Health at [www.vdh.virginia.gov/Epidemiology/Surveillance/SurveillanceData/ReportableDisease/index.htm](http://www.vdh.virginia.gov/Epidemiology/Surveillance/SurveillanceData/ReportableDisease/index.htm)

<sup>2</sup> Information obtained from the Centers for Disease Control and Prevention (CDC) at [www.cdc.gov/features/stopticks](http://www.cdc.gov/features/stopticks) and [www.cdc.gov/lyme](http://www.cdc.gov/lyme)

<sup>3</sup>Information obtained from the Virginia Department of Health at [www.google.com/url?sa=t&rct=j&q=virginia%20lyme%20disease%201989&source=web&cd=1&ved=0CC8QFjAA&url=http%3A%2F%2Fwww.vdh.state.va.us%2Fepidemiology%2FDEE%2FVectorborne%2FHCPs%2FLyme%2520Disease%2520Tracking%2520%2520Prevention%2520in%2520Virginia.ppt&ei=LvruUNuxAZGo0AHHkYGIBA&usg=AFQjCNGwzmxnewV7hA0ArqAjN1i3KV\\_qgg&bvm=bv.1357700187,d.dmg](http://www.google.com/url?sa=t&rct=j&q=virginia%20lyme%20disease%201989&source=web&cd=1&ved=0CC8QFjAA&url=http%3A%2F%2Fwww.vdh.state.va.us%2Fepidemiology%2FDEE%2FVectorborne%2FHCPs%2FLyme%2520Disease%2520Tracking%2520%2520Prevention%2520in%2520Virginia.ppt&ei=LvruUNuxAZGo0AHHkYGIBA&usg=AFQjCNGwzmxnewV7hA0ArqAjN1i3KV_qgg&bvm=bv.1357700187,d.dmg)

<sup>4</sup>Available at [www.cdc.gov/NNDSS/beta/bcasedef.aspx?CondYrID=752&DatePub=1/1/2011%2012:00:00%20AM](http://www.cdc.gov/NNDSS/beta/bcasedef.aspx?CondYrID=752&DatePub=1/1/2011%2012:00:00%20AM)

<sup>5</sup>Available at <ftp://ftp.cdc.gov/pub/Publications/mmwr/rr/rr4610.pdf>

<sup>6</sup>Available at [www.cdc.gov/NNDSS/beta/bcasedef.aspx?CondYrID=751&DatePub=1/1/2008%2012:00:00%20AM](http://www.cdc.gov/NNDSS/beta/bcasedef.aspx?CondYrID=751&DatePub=1/1/2008%2012:00:00%20AM)

## **Appendices:**

Appendix 1: 2012 Survey Results Tables

Appendix 2: Loudoun County 2006 Survey1

Appendix 3: Loudoun County 2006 Survey2

Appendix 4: Loudoun County 2012 Survey Tool

## Appendix 1 – 2012 Survey Results Tables

**Table 1: Gender (n=310 Responses<sup>@</sup>)**

Gender	Census Data (2010)	Number (%) of Cases (2012)	Number (%) of Responses (2012)	Number (%) of Responses (2006)*
Female	50.5%	301 (46%)**	143 (46%)	105 (52%)
Male	49.5%	360 (54%)**	167 (54%)	98 (48%)

<sup>@</sup> Unless stated otherwise, the number of responses refers to the 2012 survey

\* From 2006 Survey1

\*\* Statistically significant difference in percentage response compared to Census data

**Table 2: Race (n=310 Responses) and Ethnicity (n=281 Responses)**

Race/Ethnicity	Census Data (2010)	Number (%) of Cases (2012)*	Number (%) of Responses (2012)
African American	7%	10 (2%)**	3 (1%)**
Asian	14%	12 (3%)**	10 (3%)**
White	68%	378 (95%)**	295 (95%)**
Hispanic	12%		10 (4%)**
Non-Hispanic	88%		268 (95%)**

\* Race information available only for 60% of cases. Case ethnicity information not available.

\*\* Statistically significant difference in percentage response compared to Census data

**Table 3: Age Distribution (n=309 Responses)**

Age Group (Years)	Census Data (2010)	Number (%) of Cases (2012)	Number (%) of Responses (2012)	Number (%) of Responses (2006)*
0-10	18%	95 (14%)	59 (19%)	38 (19%)
11-17	12%	91 (13%)	44 (14%)	28 (14%)
18-35	21%	98 (15%)**	13 (4%)* <sup>#</sup>	19 (9%)
36-50	27%	131 (20%)**	52 (17%)**	43 (21%)
51-64	15%	161 (24%)**	85 (28%)**	45 (22%)
65-84	6%	84 (13%)**	56 (18%)* <sup>#</sup>	29 (14%)
85-100	1%	8 (1%)	0 (0%)	0 (0%)

\* From 2006 Survey1

\*\* Statistically significant difference in percentage response compared to Census data

<sup>#</sup> Statistically significant difference in percentage response compared to cases

Table 4: Zip Code (n=309 Responses)						
Zip Code	Community	Loudoun Area <sup>@</sup>	Census (2010)	Percent of Cases (2012)	Percent of Responses (2012)	Percent of Responses (2006)*
20105	Aldie	West	4%	3%	2%	2%
20117	Middleburg	West	1%	3%	3%	5%
20118	Middleburg	West	0%	3%	1%	4%
20129	Paeonian Springs	West	0%	1%	1%	1%
20131	Philomont	West	0%	1%	1%	0%
20132	Purcellville	West	5%	12%	14%	10%
20134	Purcellville	West	0%	1%	0%	3%
20135	Bluemont	West	1%	3%	4%	5%
20141	Round Hill	West	2%	5%	4%	5%
20142	Round Hill	West	0%	1%	1%	1%
20147	Ashburn	East	17%	8%	10%	12%
20148	Ashburn	East	9%	6%	5%	2%
20152	Chantilly	East	8%	2%	2%	1%
20158	Hamilton	West	1%	3%	5%	4%
20160	Lincoln	West	0%	0%	0%	0%
20164	Sterling	East	12%	3%	1%	3%
20165	Sterling	East	10%	6%	6%	9%
20166	Sterling	East	3%	1%	1%	2%
20175	Leesburg	West	9%	13%	16%	13%
20176	Leesburg	West	15%	14%	13%	10%
20180	Lovettsville	West	2%	8%	8%	6%
20197	Waterford	West	1%	2%	0%	5%

\* From 2006 Survey1

<sup>@</sup> East and West assignments were created solely for this analysis and do not reflect official Loudoun County designations

Table 5: Length of Time Between First Symptoms and Diagnosis (n=296 Responses)		
Time Interval	Number (%) of Responses (2012)	Percent Responses (2006)*
Less than 1 week	62 (21%)	89 (46%) <sup>#</sup>
Between 1 week and 1 month	114 (39%)	
Between 2 and 6 months	63 (21%)	80 (42%) <sup>#</sup>
Between 7 months and 1 year	25 (8%)	
More than 1 year	32 (11%)	22 (12%)

\* From 2006 Survey1

<sup>#</sup> Statistically significant difference in percentage response compared to 2012 responses

Table 6: Recall Being Bitten By A Tick (n=313 Responses)		
Recall Being Bitten	Number (%) of Responses (2012)	Number (%) of Responses (2006)*
Yes	90 (29%)	67 (34%)
No	223 (71%)	129 (66%)

\* From 2006 Survey1



<b>Table 7: Self-Reported Signs and Symptoms Associated With Early Localized Lyme Disease</b>		
<b>Symptoms</b>	<b>Number (%) of Responses (2012) (n=312)</b>	<b>Number (%) for Whom This Was First Symptom (2012) (n=295)</b>
Bull's eye rash (Erythema migrans)	122 (40%)	74 (25%)
Muscle aches and joint pain	183 (59%)	44 (15%)
Flu-like illness (fatigue, chills, fever, headache)	140 (46%)	67 (23%)
Fatigue	145 (47%)	30 (10%)

<b>Table 8: Additional Self-Reported Signs and Symptoms That Cases Associated With Lyme Disease</b>		
<b>Symptoms</b>	<b>Number (%) of Responses (2012) (n=293)</b>	<b>Number (%) for Whom This Was First Symptom (2012) (n=295)</b>
Bull's Eye Rash on other areas of the body	24 (8%)	5 (2%)
Facial or Bell's Palsy	17 (6%)	2 (0%)
Severe headache and neck stiffness perceived due to meningitis	47 (16%)	7 (2%)
Pain and swelling in large joints	100 (34%)	25 (9%)
Shooting pains that interfere with sleep	48 (16%)	2 (1%)
Heart palpitations/dizziness	30 (10%)	3 (1%)
Arthritis	61 (21%)	6 (2%)
Chronic neurological symptoms months to years after infection	53 (18%)	6 (2%)
None of these	103 (35%)	24 (8%)

<b>Table 9: Stratified Infection and Demographic Data (2012)</b>							
<b>Measures</b>	<b>Female</b>	<b>Known Tick</b>	<b>Care Within 1 Month</b>	<b>Age &lt;18</b>	<b>Age 18-50</b>	<b>Age 50+</b>	<b>West</b>
Known Rash	39%	36%	55% <sup>##</sup>	36%	34%	43%	43%
Care Within 1 Month	60%	52%		64%	54%	58%	60%
Western Zip Code	74%	74%	77%	69%	67%	82% <sup>##</sup>	
Any Early Symptom*	89%	83%	94% <sup>##</sup>	89%	91%	87%	90%

<sup>##</sup> Statistically significant difference in percentage response compared to other categories of respondents for this stratified variable

\* An early symptom includes Bull's eye rash, muscle aches and joint pain, flu-like illness or fatigue (Table 7)

**Table 10: Place You Believe You Picked Up The Tick (includes only those with known tick bite)  
(n=79 Responses)**

Place	Number (%) of Responses (2012)
Inside my home	1 (1%)
Outside on my personal property	41 (52%)
Contact with my pet	3 (4%)
Unknown	7 (9%)
Outside on someone else's private property	8 (10%)
Park/wooded area within Loudoun County	15 (19%)
Park/wooded area outside Loudoun County	4 (5%)

**Table 11: Activity When Bitten By Tick (includes only those with known tick bite) (n=75 Responses)**

Activity	Number (%) of Responses (2012)
Hiking	14 (19%)
Gardening/Yard Work	30 (40%)
Construction Work	0 (0%)
Hunting	2 (3%)
Farming	2 (3%)
Recreational sports	8 (11%)
Indoor Activity	2 (3%)
Unknown	17 (23%)

**Table 12: Primary Work Environment (n=284 Responses)**

Work Environment	Number Responses (2012)
Indoors	178 (63%)
Outdoors with Minimal Exposure to Nature	40 (14%)
Outdoors with Significant Exposure to Nature	66 (23%)

**Table 13: Amount Of Time Spent Outdoors From May Through July (n=307 Responses)**

Time	Number (%) of Responses (2012)
0-59 minutes	43 (14%)
1-3 hours	187 (61%)
4-6 hours	52 (17%)
7-9 hours	13 (4%)
10 or more hours	12 (4%)

Table 14: Type of Primary Residence and Residential Setting (n=307 Responses)		
Type	Number (%) of Responses (2012)	Number (%) of Responses (2006)*
House on more than ½ acre	196 (64%)	
House on less than ½ acre	89 (29%)	
Townhouse	21 (7%)	
Apartment	2 (1%)	
Suburban	136 (44%)	35 (40%)
Urban	6 (2%)	2 (2%)
Rural	165 (54%)	51 (58%)

\*From 2006 Survey2. Acreage and house type not included in the 2006 survey.

Table 15: Distance From Home to Wooded Area (n=308 Responses)		
Distance	Number (%) of Responses (2012)	Number (%) of Responses (2006)*
0-99 feet	170 (55%)	49 (52%)
100-299 feet	75 (25%)	
300 feet-1 mile	49 (16%)	
Greater than 1 mile	14 (5%)	

\*From 2006 Survey2. Only distance greater than 99 feet information not included in 2006 survey.

Table 16: Risk Factors for Ticks on Property (n=312 Responses)		
Observation	Number (%) of Responses (2012)	Number (%) of Responses (2006)*
Deer or Mice Observed Around Home	281 (90%)	81 (86%)**
Deer Damage Observed Around Home	193 (62%)	60 (64%)
Woodpile or Rock Wall on Property	182 (58%)	63 (67%)
Birdfeeders on Property	151 (49%)	
Observed a Tick on a Pet of Yours	204 (66%)	

\* From 2006 Survey2. Birdfeeder and observing a tick on a pet information not included in 2006 survey.

\*\* Referenced observing deer around home but did not reference mice

**Table 17: Stratified Tick Risk and Prevention Measures Before Diagnosis**

Measures	Western Loudoun County	House on Greater Than ½ Acre	Rural Residential Setting	Woods 0-99 Feet From Property
Perform Tick Checks	92% <sup>##</sup>	88%	88%	85%
Used Pesticides	17%	19%	19%	23%
Known Tick	29%	28%	31%	31%
Infected on Own Property	70% <sup>##</sup>	67%	70% <sup>##</sup>	67%
Deer/Mice Observed Around Home	94% <sup>##</sup>	97% <sup>##</sup>	98% <sup>##</sup>	95% <sup>##</sup>
Deer Damage Observed Around Home	71% <sup>##</sup>	77% <sup>##</sup>	82% <sup>##</sup>	75% <sup>##</sup>
Observed Tick on Pet	75% <sup>##</sup>	76% <sup>##</sup>	78% <sup>##</sup>	70%

<sup>##</sup> Statistically significant difference in percentage response compared to other categories of respondents for that variable

**Table 18: Personal Preventive Measures Before Diagnosis (DX) (n=268) and After Diagnosis (n=293)**

Measures	Before Diagnosis (2006)*	Before Diagnosis (2012)	After Diagnosis (2012)	Before DX- West (2012)	Before DX- Age <18 (2012)	Before DX- Female (2012)
Check for ticks	63 (66%)	228 (85%)**	271 (92%) <sup>#</sup>	88% <sup>##</sup>	91% <sup>##</sup>	82%
Wear long sleeve shirts, pants and long socks	46 (48%)	64 (24%)**	113 (38%) <sup>#</sup>	25%	8% <sup>##</sup>	26%
Use insect repellent	39 (41%)	91 (34%)	163 (55%) <sup>#</sup>	32%	50% <sup>##</sup>	38%
Tuck your pants into socks	16 (17%)	17 (6%)**	41 (14%) <sup>#</sup>	7%	2% <sup>##</sup>	13% <sup>##</sup>
Wear light-colored clothing	55 (58%)	35 (13%)**	57 (19%)	14%	8% <sup>##</sup>	19% <sup>##</sup>
None of these		10 (4%)	4 (1%)	3%	2%	4%

\*Includes the percentage of respondents answering “Always” or “Sometimes” in 2006 Survey2. “None of These” was not included in the 2006 survey options.

\*\* Statistically significant difference in percentage response compared to 2006

<sup>#</sup> Statistically significant difference in percentage response compared to Before Diagnosis

<sup>##</sup> Statistically significant difference in percentage response compared to all other categories of 2012 respondents for that variable

<b>Table 19: Tick Prevention Measures Before (n=203 Responses) and After Diagnosis (n=205 Responses)</b>					
<b>Measures</b>	<b>Before Diagnosis (2006)*</b>	<b>Before Diagnosis (2012)</b>	<b>After Diagnosis (2012)</b>	<b>Before Diagnosis- West (2012)</b>	<b>After Diagnosis- West (2012)</b>
Used pesticides for tick control	4 (4%)	38 (19%)**	81 (40%) <sup>#</sup>	18%	38%
Removed brush or leaf litter	9 (9%)	68 (33%)**	89 (43%) <sup>#</sup>	42% <sup>##</sup>	48% <sup>##</sup>
Used wood chips/ gravel barriers between woods and yard	10 (10%)	14 (7%)	15 (7%)	7%	9%
Fenced property to protect from deer	16 (17%)	35 (17%)	17 (8%) <sup>#</sup>	17%	8%
No known ticks on property		57 (28%)	37 (18%) <sup>#</sup>	21% <sup>##</sup>	14% <sup>##</sup>
Am not permitted to perform these activities		20 (10%)	21 (10%)	9%	10%
None of these		20 (10%)	14 (7%)	9%	7%

\*Includes the percentage of respondents answering “Always” or “Sometimes” in 2006 Survey2. Ticks on property and ability to perform the listed activities was not included in 2006 survey.

\*\*Statistically significant difference in percentage response compared to 2006

<sup>#</sup>Statistically significant difference in percentage response compared to 2012 before diagnosis

<sup>##</sup> Statistically significant difference in percentage response compared to East respondents

## Appendix 2



Environmental Health  
Phone: 703 / 777-0234  
Fax: 703 / 771-5023

### Loudoun County Health Department

P.O. Box 7000  
Leesburg VA 20177-7000



Community Health  
Phone: 703 / 777-0236  
Fax: 703 / 771-5393

REC'D FEB 27 2006

February 20, 2006

**Over the past five years the number of reported Lyme disease cases in Loudoun County has increased from 29 to over 100 per year, now representing over 40% of all Lyme cases reported in Virginia.**

The mission of the Health Department is to enhance and ensure the health of everyone in Loudoun County. We have started conducting public education campaigns to increase awareness of this problem, but to truly make a difference we need your help.

On the opposite side of this letter is a brief survey form designed to help us determine how people are contracting Lyme disease in Loudoun County. **Your participation in this anonymous survey is key to our ability to improve our interventions by focusing our efforts on those at highest risk of getting infected.** A second study is planned for later this year, designed to build on the results from this initiative.

**Please take a few minutes to complete this survey and return it in the enclosed stamped envelope or fax back to me at 703-771-5023 by Friday March 10.** Since this is an anonymous survey, it is important that you do not include your name or address on the form; if you would like to provide additional information or have questions or concerns, please contact me directly at 703-771-5829 or [dgoodfri@loudoun.gov](mailto:dgoodfri@loudoun.gov).

Thank you in advance for taking the time to complete this survey. With your help, we can work together to keep our fellow Loudoun citizens safe from Lyme.

Sincerely,

David P. Goodfriend, MD, MPH  
Director



Appendix 2

**Loudoun County Health Department  
Lyme Disease Survey**

All questions refer to the person diagnosed with Lyme disease

1. In what age group do you belong (check one)?  
☒ 0-10   ☐ 11-17   ☐ 18-35   ☐ 36-50   ☐ 51-64   ☐ 65-84   ☐ >85
2. What is your zip code? 20176
3. What is your sex? (check one) ☐ Female   ☒ Male
4. In what year were you diagnosed? 2005
5. How was your diagnosis made? (check all that apply)  
☐ Rash   ☒ Lab test   ☐ Other (describe) Swollen knee
6. Was there a known tick bite? (check one) ☐ Yes   ☒ No
7. Do you believe you may have contracted the tick from your pet/animal?  
☐ Yes   ☒ No   If yes, what type of pet/animal? \_\_\_\_\_
8. Where do you think you may have picked up the tick? (check all that apply)  
☐ Your backyard   ☐ On a trail or park   ☐ Work  
☐ Other (describe) Don't know
9. How long after you were infected did you get diagnosed? (check one)  
☐ Less than 1 month   ☒ 1 month - 1 year   ☐ More than 1 year
10. What prompted you to seek medical care? (check all that apply)  
☐ Tick   ☐ Rash   ☐ Arthritis   ☒ Neurological symptoms (Bell's palsy muscle aches/pains, changes in concentration, depression, decreased energy)  
☐ Other (describe) \_\_\_\_\_
11. Are you still having signs and symptoms of Lyme Disease?  
☐ Yes   ☒ No   If yes, what are they? \_\_\_\_\_

Please return survey by March 10 in the enclosed stamped envelope or by fax at 703-771-5023

50

## Appendix 3

### PUBLIC HEALTH BURDEN OF LYME DISEASE in LOUDOUN COUNTY

*If you are completing this questionnaire for someone less than age 18, please provide your name and relationship to the individual.*

Name: \_\_\_\_\_ Relationship: \_\_\_\_\_

*Please complete the remainder of the survey on behalf of the individual reported as a Lyme case.*

#### DEMOGRAPHICS

1. Name \_\_\_\_\_
2. Current Street Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_ County (if other than Loudoun) \_\_\_\_\_
3. Were you living at this address at the time of your most recent Lyme diagnosis? ☐ Yes ☐ No
4. If *no*, please provide your residential address at the time of your Lyme diagnosis  
Street Address: \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_ County \_\_\_\_\_
5. Date of Birth \_\_\_\_/\_\_\_\_/\_\_\_\_
6. Sex ☐ Male ☐ Female
7. Race ☐ American Indian or Alaska Native ☐ African American ☐ Asian  
☐ White ☐ Pacific Islander ☐ Other
8. Ethnicity ☐ Hispanic ☐ Not Hispanic ☐ Unknown
9. Occupation at time of diagnosis \_\_\_\_\_

#### PHYSICIAN AND DIAGNOSIS INFORMATION

10. When did you first begin to *experience symptoms* associated with Lyme disease? For a list of common Lyme disease symptoms go to page 8 (Appendix).  
Date symptoms began: \_\_\_\_/\_\_\_\_/\_\_\_\_ \*If day is unknown please complete month and year
11. When were you first *diagnosed* with Lyme disease by a physician? \_\_\_\_/\_\_\_\_/\_\_\_\_  
\*If day is unknown please complete month and year
12. Please provide the name and contact information of the physician who *diagnosed* you with Lyme during 2003-2005:  
Physician or Hospital/Clinic name \_\_\_\_\_  
Address \_\_\_\_\_  
Phone ( ) \_\_\_\_ - \_\_\_\_\_



### Appendix 3

13. Do you still currently see this physician for any Lyme-related symptoms? ☐ Yes ☐ No  
If yes, please go to Q #15.

14. If no (Q13), please provide the name and contact information of the physician you currently see for any Lyme-related symptoms

Physician name \_\_\_\_\_

Address \_\_\_\_\_

Phone (    ) \_\_\_\_\_ - \_\_\_\_\_

☐ Currently do NOT see a physician for Lyme disease

15. Have you seen any specialists for treatment of your Lyme signs and symptoms? ☐ Yes ☐ No  
If no, please go to Q #17.

16. If yes to Q15, please check all specialists you have seen specifically for Lyme-related symptoms only:

☐ Primary care doctor other than listed above ☐ Infectious disease ☐ Rheumatologist

☐ Cardiologist ☐ Neurologist ☐ Other (please specify) \_\_\_\_\_

17. In order to diagnose Lyme disease, laboratory tests are often needed. Do you recall what lab tests, if any, may have been ordered by your physician or independently by you or another agency? ☐ Yes ☐ No (If no, please go to the Symptoms section, Page 3, Q# 19.)

18. If yes, please indicate which laboratory tests were used to confirm presence of Lyme antibodies or the *Borrelia burgdorferi* bacteria. If a laboratory test was performed please complete the results, date of test, ordered by, and laboratory name columns to the best of your ability. For *ordered by* please indicate whether the test was ordered by your physician, yourself, or another agency. Please add rows if a specific lab test was performed multiple times.

Laboratory Test	Was test performed?			Results				Date of Test	Who was test ordered by? MD, Self, other	Name of Laboratory performing test
	Yes	No	Unknown	+	-	=	U			
Lyme IgM EIA or IFA										
Lyme IgG EIA or IFA										
Lyme IgM Western Blot										
IgG Western Blot										
Bacterial culture										
PCR										
Urine Antigen (Dot Blot)										
Other:										
Other:										

## Appendix 3

### SYMPTOMS & MEDICAL HISTORY

Common signs and symptoms for *acute or early* Lyme disease include: erythema migrans (a red rash which looks like a 'bull's eye'), general tiredness, fever, headache, stiff neck, muscle aches, and joint pain. (See Appendix on page #8)

19. Do you have a history of *acute or early* Lyme disease? ☐ Yes ☐ No (If no, go to Q #22)

20. If yes, when did you first begin to experience *acute symptoms*? \_\_\_\_/\_\_\_\_/\_\_\_\_

21. What symptoms associated with *acute* Lyme disease did you experience (complete table)?

Symptom	Presence Y=Yes, N= No, U=Unknown	Doctor diagnosed? (check if yes)	Approximate Date began	Approximate Date ended
Erythema migrans (Bull's eye rash)	<input type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> U If Y, size of rash ____ cm	<input type="checkbox"/>		
Joint pain/muscle aches	<input type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> U	<input type="checkbox"/>		
Flu-like illness (fever, fatigue)	<input type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> U	<input type="checkbox"/>		
Fatigue	<input type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> U	<input type="checkbox"/>		
Other: _____	<input type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> U	<input type="checkbox"/>		
Other: _____	<input type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> U	<input type="checkbox"/>		

Common signs and symptoms for *chronic or late* Lyme disease include: arthritis, Bell's palsy, neurological problems, and heart problems among others. (See Appendix on page #8)

22. Do you currently have or do you have a history of *chronic or late* Lyme disease? ☐ Yes ☐ No  
(If no, go to Q 25)

23. If yes, when did you first begin to experience *chronic symptoms*? \_\_\_\_/\_\_\_\_/\_\_\_\_

24. What symptoms associated with *chronic or late* Lyme disease have you experienced?

Symptom	Presence Y=Yes, N= No, U=Unknown	Doctor diagnosed? (check if yes)	Approximate Date began	Approximate Date ended
Bell's palsy or other cranial neuritis (weakness of facial muscles)	<input type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> U	<input type="checkbox"/>		
Lymphocytic meningitis	<input type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> U	<input type="checkbox"/>		
Encephalitis/Encephalomyelitis	<input type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> U	<input type="checkbox"/>		
Atrioventricular block	<input type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> U	<input type="checkbox"/>		
Arthritis/joint pains and swelling	<input type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> U	<input type="checkbox"/>		
Other: _____	<input type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> U	<input type="checkbox"/>		
Other: _____	<input type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> U	<input type="checkbox"/>		
Other: _____	<input type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> U	<input type="checkbox"/>		

## Appendix 3

### Medical History

25. Do you have a history of any of the following medical conditions?

Diabetes	<input type="checkbox"/> Yes <input type="checkbox"/> No	Fibromyalgia	<input type="checkbox"/> Yes <input type="checkbox"/> No
Cardiovascular Disease	<input type="checkbox"/> Yes <input type="checkbox"/> No	ALS (Lou Gehrig's Disease)	<input type="checkbox"/> Yes <input type="checkbox"/> No
Chronic Fatigue Syndrome	<input type="checkbox"/> Yes <input type="checkbox"/> No	Multiple Sclerosis	<input type="checkbox"/> Yes <input type="checkbox"/> No
Rocky Mountain Spotted Fever	<input type="checkbox"/> Yes <input type="checkbox"/> No	Ehrlichiosis	<input type="checkbox"/> Yes <input type="checkbox"/> No
Babesiosis	<input type="checkbox"/> Yes <input type="checkbox"/> No	Leptosporidiosis	<input type="checkbox"/> Yes <input type="checkbox"/> No

### TREATMENT

26. Have you ever been treated for Lyme disease? ☐ Yes ☐ No ☐ Unknown  
(If no, go to Q #29).

27. Please list all medications, including prescription and over the counter meds, you have been prescribed or use specifically for the treatment of your Lyme disease and related symptoms since 2001.

Medication name	Is this a prescription drug?	Dose (mg)	Oral (O) or IV or Pic Line (PIC)	Approximate date began	Approximate date ended
	<input type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> U		<input type="checkbox"/> O <input type="checkbox"/> IV <input type="checkbox"/> PIC		
	<input type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> U		<input type="checkbox"/> O <input type="checkbox"/> IV <input type="checkbox"/> PIC		
	<input type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> U		<input type="checkbox"/> O <input type="checkbox"/> IV <input type="checkbox"/> PIC		
	<input type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> U		<input type="checkbox"/> O <input type="checkbox"/> IV <input type="checkbox"/> PIC		
	<input type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> U		<input type="checkbox"/> O <input type="checkbox"/> IV <input type="checkbox"/> PIC		
	<input type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> U		<input type="checkbox"/> O <input type="checkbox"/> IV <input type="checkbox"/> PIC		
	<input type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> U		<input type="checkbox"/> O <input type="checkbox"/> IV <input type="checkbox"/> PIC		
	<input type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> U		<input type="checkbox"/> O <input type="checkbox"/> IV <input type="checkbox"/> PIC		

Describe your treatment regimen (number of days or frequency of treatments) for each medication in the space below:

28. Do you believe you had any side effects as a result of treatments used for Lyme disease?  
☐ Yes ☐ No

*If yes, please describe side effects:*

29. Have you ever had the LymeRix vaccine (note that use of this vaccine has been discontinued since February 2002)?  
☐ Yes ☐ No ☐ Unknown

If yes, when did you receive LymeRix? Month \_\_\_\_\_ Year \_\_\_\_\_  
How many booster of Lyme Rix did you receive? \_\_\_\_\_

## Appendix 3

### COSTS

30. Have you been covered by health insurance for the past 5 years? ☐ Yes ☐ No (If no, skip to Q 31)

Specific only to your Lyme diagnosis, doctor's visits, and treatment please indicate whether your insurance covered the following either in full or partially (after a co-pay):

Primary Doctors' visit	<input type="checkbox"/> Fully	<input type="checkbox"/> Partially	<input type="checkbox"/> Not covered	<input type="checkbox"/> Unknown
Specialist Consultation	<input type="checkbox"/> Fully	<input type="checkbox"/> Partially	<input type="checkbox"/> Not covered	<input type="checkbox"/> Unknown
Medications	<input type="checkbox"/> Fully	<input type="checkbox"/> Partially	<input type="checkbox"/> Not covered	<input type="checkbox"/> Unknown
Laboratory tests	<input type="checkbox"/> Fully	<input type="checkbox"/> Partially	<input type="checkbox"/> Not covered	<input type="checkbox"/> Unknown
Hospital stays	<input type="checkbox"/> Fully	<input type="checkbox"/> Partially	<input type="checkbox"/> Not covered	<input type="checkbox"/> Unknown

31. Please estimate total out-of-pocket expenses (i.e. co-payments and expenses not covered by your healthcare insurance) that you have had to pay specific to Lyme disease for the following categories

Doctor's visits ☐ < \$1,000 ☐ \$1,000-5,000 ☐ \$5,000-10,000 ☐ > \$10,000

Medications ☐ < \$1,000 ☐ \$1,000-5,000 ☐ \$5,000-10,000 ☐ > \$10,000

Other treatments ☐ < \$1,000 ☐ \$1,000-5,000 ☐ \$5,000-10,000 ☐ > \$10,000

Laboratory tests ☐ < \$1,000 ☐ \$1,000-5,000 ☐ \$5,000-10,000 ☐ > \$10,000

Hospital stays ☐ < \$1,000 ☐ \$1,000-5,000 ☐ \$5,000-10,000 ☐ > \$10,000

Other (please specify category and amount)

\_\_\_\_\_ ☐ < \$1,000 ☐ \$1,000-5,000 ☐ \$5,000-10,000 ☐ > \$10,000

\_\_\_\_\_ ☐ < \$1,000 ☐ \$1,000-5,000 ☐ \$5,000-10,000 ☐ > \$10,000

32. How many days of work and/or school have you lost because of Lyme disease?

☐ 0 or less than 1 day ☐ 1- 5 days ☐ 6-10 days ☐ 11-15 days ☐ 16 days or more

33. Using the scale below please circle how Lyme disease has affected your daily activity (i.e. walking, bathing, dressing, getting in and out of bed/chairs, eating) since being diagnosed:

0	1	2	3	4	5	6	7	8	9	10
No effect on activity									Activity severely compromised (cannot perform normal activities)	

### EXPOSURE INFORMATION

34. Do you recall being bitten by a tick prior to your most recent diagnosis? ☐ Yes ☐ No  
(If No, please skip to Question #40)

35. If yes, when were you bitten by a tick? \_\_\_\_\_/\_\_\_\_\_/\_\_\_\_\_

\_\_\_\_\_/\_\_\_\_\_/\_\_\_\_\_

### Appendix 3

If you were bitten by a tick multiple times please answer the following questions based on your most recent tick bite.

36. Did you have to remove the tick?

- ☐ Yes ☐ No, the tick was no longer attached

If yes, how did you remove the tick (check one)?

- ☐ Using tweezers  
☐ Candle/lighter/match  
☐ Smothered in Vaseline or other lotion/ointment  
☐ Removed by a physician, nurse, or other medical specialist  
☐ Other \_\_\_\_\_

37. How long was the tick attached before you removed it? \_\_\_\_\_ hours ☐ Do not recall

38. Where were you bitten by a tick (please check only one)?

- ☐ Home and personal property ☐ Park/wooded area within Loudoun county  
☐ Park/wooded area outside of Loudoun county ☐ Other \_\_\_\_\_

Address or Name of park/attraction \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_

County (if known) \_\_\_\_\_

39. What activity were you participating in when you were exposed to the tick(s) (please check one)?

- ☐ Hiking ☐ Gardening/Yardwork ☐ Construction Work ☐ Hunting  
☐ Farming ☐ Recreational sports ☐ Indoor Activity ☐ Other \_\_\_\_\_

### PREVENTION

---

40. Please check how often you did the following PERSONAL preventive activities BEFORE your Lyme diagnosis

ACTIVITY done BEFORE Lyme diagnosis Relevant to any outdoor activities	Never	Rarely	Sometimes	Always
Check for ticks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wear long sleeve shirts, pants, and long socks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Use insect repellent with DEET or permethrin	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tuck your pants into your socks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wear light-colored clothing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (specify)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### Appendix 3

41. Please check how often you did the following PERSONAL preventive activities AFTER your Lyme diagnosis

ACTIVITY done AFTER Lyme diagnosis Relevant to any outdoor activities	Never	Rarely	Sometimes	Always
Check for ticks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wear long sleeve shirts, pants, and long socks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Use insect repellent with DEET or permethrin	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tuck your pants into your socks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wear light-colored clothing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (specify)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

42. Please check if you did any of the following activities either before or after your Lyme diagnosis. If you do not own property please check "Not Applicable".

ACTIVITY	Done BEFORE Lyme diagnosis	Done AFTER Lyme diagnosis	Not Applicable
Used pesticides for tick control	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Removed brush or leaf litter in order to control ticks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Used wood chips and gravel barriers between woods and yard	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fenced property to protect from deer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

#### RESIDENTIAL SETTING & OTHER EXPOSURES

43. Do you have pets (excluding pets kept in an aquarium or cage)? ☐ Yes ☐ No (If no, go to Q #46)  
If yes, please specify what pets: ☐ Dog(s) ☐ Cat(s) ☐ Other \_\_\_\_\_

44. Do your pets go outdoors? ☐ Yes ☐ No

45. Do you use tick/flea collars or Frontline on any pets that go outdoors? ☐ Yes ☐ No

#### Residential Setting

*\*Answer all questions based on your residence at the time you believe you were infected*

46. Please describe your residential setting: ☐ Suburban ☐ Urban ☐ Rural

47. Proximity of home to woods ☐ 0-99 feet ☐ 100-299 feet ☐ 300 feet- 1 mile ☐ > 1 mile

48. Deer or mice observed near home ☐ Yes ☐ No

49. Deer or mice damage to trees or shrubs in yard ☐ Yes ☐ No ☐ Not applicable (no yard)

50. Presence of woodpile or rock wall on property ☐ Yes ☐ No ☐ Not applicable (no yard)

51. Presence of bird feeder on property ☐ Yes ☐ No

### Appendix 3

52. Do you participate in any of the following outdoor activities (*check all that apply*)?

- ☐ *Recreational sports*
- ☐ *Hunting*
- ☐ *Frequent picnics*
- ☐ *Gardening/yardwork*
- ☐ *Hiking*
- ☐ *Camping*
- ☐ *Other* \_\_\_\_\_

#### EDUCATION & HEALTH DEPARTMENT ACTIVITIES

---

53. Prior to your Lyme diagnosis, where have you received Lyme disease prevention information (*check all that apply*)?

- ☐ *I have not received any Lyme disease information (go to Q54)*
- ☐ *Doctor's office*
- ☐ *Internet*
- ☐ *Health department*
- ☐ *Library*
- ☐ *Support group*
- ☐ *TV/radio*
- ☐ *Other* \_\_\_\_\_

54. Are you a member of a Lyme disease support group? ☐ Yes ☐ No

If yes, which one(s): \_\_\_\_\_

55. Would you be interested in a health department educational seminar regarding Lyme disease?

- ☐ Yes ☐ No ☐ *Unsure*

56. What would you like the health department to do in order to help raise awareness and/or help prevent Lyme disease?

---

#### APPENDIX LYME DISEASE SIGNS & SYMPTOMS

##### *Acute or early Lyme disease*

- Erythema migrans (red rash which looks like a bull's eye)
- Flu-like illness (fatigue, chills, fever, headache)
- Muscle and joint aches
- Swollen lymph nodes

##### *Chronic or late Lyme disease*

- Facial or Bell's palsy (loss of muscle tone on face)
- Severe headaches and stiffness due to meningitis
- Shooting pains and/or numbness or tingling in the hands and feet
- Heart palpitations and dizziness due to atrioventricular block
- Joint pains and swelling
- Arthritis

---

*For health department use only:*

- ☐ Confirmed ☐ Probable ☐ Unconfirmed  
☐ 2004 ☐ 2005 ☐ 200\_\_

☐ Other  
Entered by: \_\_\_\_\_

# 2012 Loudoun County Health Department Lyme Case Survey

## DEMOGRAPHICS

This online survey will close on September 30, 2012.

You may also mail the completed form via the enclosed stamped envelope by September 30, 2012.

**\*1. Confidential Unique ID (assigned by Health Department): Enter the 6 digit number located in your letter.**

**2. Your zip code when you first became sick or were first diagnosed with Lyme Disease:**

**3. Your Gender: (Check one only)**

- ☐ Female
- ☐ Male

**4. Your Age Group (in years):**

- ☐ 0-10
- ☐ 11-17
- ☐ 18-35
- ☐ 36-50
- ☐ 51-64
- ☐ 65-84
- ☐ 85 and over

**5. Your Race: (Check one only)**

- ☐ White
- ☐ Asian
- ☐ African American
- ☐ Pacific Islander
- ☐ American Indian or Alaska Native

Other (please specify)



**2012 Loudoun County Health Department Lyme Case Survey****6. Your Ethnicity: (Check one only)**

- ☐ Hispanic
- ☐ Not Hispanic
- ☐ Unknown

**7. Your primary work environment at time of illness onset: (Check one only)**

- ☐ Indoors
- ☐ Outdoors with minimal exposure to nature
- ☐ Outdoors with significant exposure to nature

**DISEASE INFORMATION****8. How long was it between your first symptoms of Lyme disease and when you were diagnosed? (Check one only)**

- ☐ Less than 1 week
- ☐ Between 1 week and 1 month
- ☐ Between 2 and 6 months
- ☐ Between 7 months and 1 year
- ☐ More than 1 year

**9. What symptoms associated with early localized Lyme disease did you experience? (Check all that apply)**

- ☐ a. Bull's eye rash (erythema migrans or EM)
- ☐ b. Muscle aches and joint pain
- ☐ c. Flu-like illness (fatigue, chills, fever, headache)
- ☐ d. Fatigue
- ☐ e. None of these

## 2012 Loudoun County Health Department Lyme Case Survey

### 10. What additional symptoms associated with Lyme disease did you experience? (Check all that apply)

- ☐ f. Additional Bull's eye rashes (erythema migrans or EM) in other areas of the body
- ☐ g. Facial or Bell's palsy (loss of muscle tone on one or both sides of your face)
- ☐ h. Severe headaches and neck stiffness due to meningitis (inflammation of the spinal cord)
- ☐ i. Pain and swelling in the large joints (such as knees)
- ☐ j. Shooting pains that may interfere with sleep
- ☐ k. Heart palpitations and dizziness due to changes in heartbeat
- ☐ l. Arthritis (persistent joint pains and swelling)
- ☐ m. Chronic neurological complaints months to years after infection (including shooting pains, numbness or tingling in the hands or feet, and problems with short-term memory)
- ☐ n. None of these

### 11. Of those symptoms checked in #8 and #9, check the ONE (1) letter corresponding to the symptom that you FIRST experienced with your Lyme disease? (Check one letter only)

- ☐ a.
- ☐ b.
- ☐ c.
- ☐ d.
- ☐ e.
- ☐ f.
- ☐ g.
- ☐ h.
- ☐ i.
- ☐ j.
- ☐ k.
- ☐ l.
- ☐ m.
- ☐ None of these

## TICKS

The following questions pertain to the presence of a tick before your most recent diagnosis of Lyme disease.

**2012 Loudoun County Health Department Lyme Case Survey****12. Do you recall being bitten by a tick?**

- ☐ Yes
- ☐ No

**13. Where do you believe you picked up the tick? (Check one only)**

- ☐ Inside my home
- ☐ Outside on my personal property
- ☐ Contact with my pet
- ☐ Unknown
- ☐ Outside on someone else's private property
- ☐ Park/wooded area within Loudoun County
- ☐ Park/wooded area outside Loudoun County

Other (please specify)

**14. What activity were you participating in when you were exposed to the tick(s)? (Check one only)**

- ☐ Hiking
- ☐ Gardening/Yard work
- ☐ Construction work
- ☐ Hunting
- ☐ Farming
- ☐ Recreational sports
- ☐ Indoor activity
- ☐ Unknown

Other (please specify)

**RISK FACTORS**

**2012 Loudoun County Health Department Lyme Case Survey**

**15. At the time you believe you were infected, approximately how many hours a day did you average being outdoors between May and July? (Check one only)**

- ☐ 0 to 59 minutes
- ☐ 1 to 3 hours
- ☐ 4 to 6 hours
- ☐ 7 to 9 hours
- ☐ 10 or more hours

**16. Which, if any, of the following personal preventive activities did you routinely perform when in a tick prone area BEFORE your Lyme disease diagnosis? (Check all that apply)**

- ☐ Check for ticks
- ☐ Wear long sleeve shirts, pants, and long socks
- ☐ Use insect repellent
- ☐ Tuck your pants into your socks
- ☐ Wear light-colored clothing
- ☐ None of these

**17. Which, if any, of the following personal preventive activities did you routinely perform when in a tick prone area AFTER your Lyme disease diagnosis? (Check all that apply)**

- ☐ Check for ticks
- ☐ Wear long sleeve shirts, pants, and long socks
- ☐ Use insect repellent
- ☐ Tuck your pants into your socks
- ☐ Wear light-colored clothing
- ☐ None of these

## 2012 Loudoun County Health Department Lyme Case Survey

**18. If you have ticks on your property which, if any, of the following activities have you performed on your property BEFORE your Lyme disease diagnosis? (Check all that apply)**

- ☐ Used pesticides for tick control
- ☐ Removed brush or leaf litter in order to control ticks
- ☐ Used wood chips and/or gravel barriers between woods and yard
- ☐ Fenced property to protect from deer
- ☐ No known ticks on property
- ☐ Am not permitted to perform these activities
- ☐ None of these

**19. If you have ticks on your property which, if any, of the following activities have you performed on your property AFTER your Lyme disease diagnosis? (Check all that apply)**

- ☐ Used pesticides for tick control
- ☐ Removed brush or leaf litter in order to control ticks
- ☐ Used wood chips and/or gravel barriers between woods and yard
- ☐ Fenced property to protect from deer
- ☐ No known ticks on property
- ☐ Am not permitted to perform these activities
- ☐ None of these

## RESIDENCE

The following questions pertain to where you lived at the time of your most recent diagnosis of Lyme disease.

**20. Your primary residence: (Check one only)**

- ☐ House on more than 1/2 acre
- ☐ House on less than 1/2 acre
- ☐ Townhouse
- ☐ Apartment

Other (please specify)

**2012 Loudoun County Health Department Lyme Case Survey****21. Describe your residential setting: (Check one only)**

- ☐ Suburban
- ☐ Urban
- ☐ Rural

**22. Proximity of your home to woods: (Check one only)**

- ☐ 0 to 99 feet
- ☐ 100 to 299 feet
- ☐ 300 feet to 1 mile
- ☐ Greater than 1 mile

**23. Have you observed deer or mice near your home/property? (Check one only)**

- ☐ Yes
- ☐ No

**24. Have you observed deer related damage to trees or shrubs in your yard? (Check one only)**

- ☐ Yes
- ☐ No
- ☐ Not applicable (no yard)

**25. Is there a woodpile or rock wall on your property? (Check one only)**

- ☐ Yes
- ☐ No
- ☐ Not applicable (no yard)

**26. Is there a bird feeder(s) on your property? (Check one only)**

- ☐ Yes
- ☐ No
- ☐ Not applicable (no property)

**27. Have you ever noticed a tick on a pet of yours? (Check one only)**

- ☐ Yes
- ☐ No
- ☐ Not applicable (no pet)